Association of Zinc, Copper and Iron Levels with Birth Weight

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Abstract**—***This study was aimed to find out relationship of maternal Zinc, Copper and Iron levels with birth weight. Epidemiological observations are that Low birth weight babies i.e. weighing less than 2,500 grams, are approximately 20 times more likely to die than heavier babies. LBWs are more common in developing than developed countries. This study was conducted on 100 new born infant and their mother. Mothers of just delivered babies were investigated for assessing serum zinc, iron and copper levels on atomic absorption spectrophotometer. Along with this cord blood samples of newborn delivered by these identified women were investigated for zinc, iron and copper levels. Simultaneously birth weight of newborns delivered by these mothers were assessed. Association of maternal Zinc, Copper and Iron with birth weight of newborn was analyzed by unpaired* student's' *test of significance. It was found in this study that maternal and newborn serum Zinc and Copper level were significantly lower and higher respectively in LBWs whereas serum Iron was not associated with birth weight of infants.*

Keywords— Maternal Zinc, Maternal Copper, Maternal Iron, Low Birth Weight

I. INTRODUCTION

The Low birth weight has been defined by the World Health Organization (WHO) as weight at birth of less than 2,500 grams (5.5 pounds),[1] This practical cut-off for international comparison is based on epidemiological observations that infants weighing less than 2,500 g are approximately 20 times more likely to die than heavier babies.[2] LBWs are more common in developing than developed countries. A birth weight below 2,500 grams contributes to a range of poor health outcomes.

WHO and UNICEF published the first global, regional and country estimates of low birth weight rates in1992.[3] More than 20 million infants worldwide, representing 15.5 per cent of all births are born with low birth weight, 95.6 per cent of them in developing countries. The level of low birth weight in developing countries (16.5 per cent) is more than double the level in developed regions (7 per cent). At that time, the low birth weight rate for industrialized countries was around 7 per cent, and in less developed countries it ranged between 5 and 33 per cent, with an average of 17 per cent.[3] The process of monitoring progress towards international goals on low birth weight reduction led to a greater recognition of the limitations of the available data as particular the relatively small proportion of infants weighed at birth.

A baby's low birth weight is either the result of preterm birth (before 37 weeks of gestation) or of restricted foetal (intrauterine) growth. Low birth weight is closely associated with foetal and neonatal mortality and morbidity, inhibited growth and cognitive development and chronic diseases later in life.[4]

Many factors affect the duration of gestation and of foetal growth and intern the birth weight. They are related to the infant, mother or physical environment and play an important role in determining the infant's birth weight and future health of newborn.[5] Although exact cause of low birth weight is still far away from reality but many factors have been implicated including maternal nutrition, maternal smoking, maternal alcohol etc[6-9].

Among maternal nutritional factors, maternal zinc status as been reported to have an effect on birth weight of babies. Although many studies were conducted on association of maternal zinc status and birth weight but no consensus exists on this association in human. However, Zinc is essentially required for protein synthesis and its deficiency is associated with short stature. [10-12] The So this study was conducted on 100 newborn and their mothers with the aim to find out association between birth weight and maternal Zinc along with Copper and Iron. These two trace elements i.e. Copper and Iron, are components of several enzyme and other protein which are required for development of foetus.

II. METHODOLOGY

This present cross-sectional, analytic study was conducted in the Department of Biochemistry, in association with the Department of Obstetrics and Gynaecology, S.M.S Medical College and attached group of Hospitals, Jaipur (Rajasthan) India.

Sample size was calculated 86 subjects at 95% confidence limit and absolute allowable error 8% assuming 16.5% Low Birth Weight babies[3] in community. So for the study purpose 100 newborn with their mothers was taken in this study.

After getting approval from the Ethical Committee of the S.M.S Medical College, This study was conducted on 100 newborn and their mothers i.e. pregnant women attending the antenatal clinic and labor room for delivery of the Department of Obstetrics and Gynecology S.M.S Medical College and attached group of Hospitals, Jaipur, for delivery. Selected mothers were 28 weeks or more weeks of gestation, who were vegetarian and non smoker. ANC who was not normotensive and average body weight were excluded from study. Mother who was having and other chronic disease and taking any type of drug for preceding one month except iron and folic acid were also excluded from study. Objectives of the study were explained to the women willing to participate and were enrolled for the study. Written informed consent was obtained from all the pregnant women participated. Identity of participants were kept confidential and used only for research purpose.

After collecting general information about identified mothers, 5 ml sample of venous blood from cubital vein was drawn when these identified women came for delivery. likewise, when baby was born of these identified mothers, new born cord blood samples were taken within 5 minutes of delivery. Blood from newborn was collected from maternal end of the umbilical cord to coincide precisely with the new born venous blood. Blood samples of mothers as well as newborns were collected by aseptic techniques with precaution to avoid trace metal contamination. These blood collected blood samples were send to laboratory of Biochemistry Department for testing. Apart from routine test, trace elements like Copper, iron and zinc was measured from mother's as well as newborn's blood samples by atomic absorption spectrophotometer (AAS4141)[13]. Birth weight of newborns of identified mothers was also measured just after birth.

Data thus collected were entered in MS Excel 2007 worksheet in the form of master chart. These data were statistically analyzed by using student ‘t’ test.

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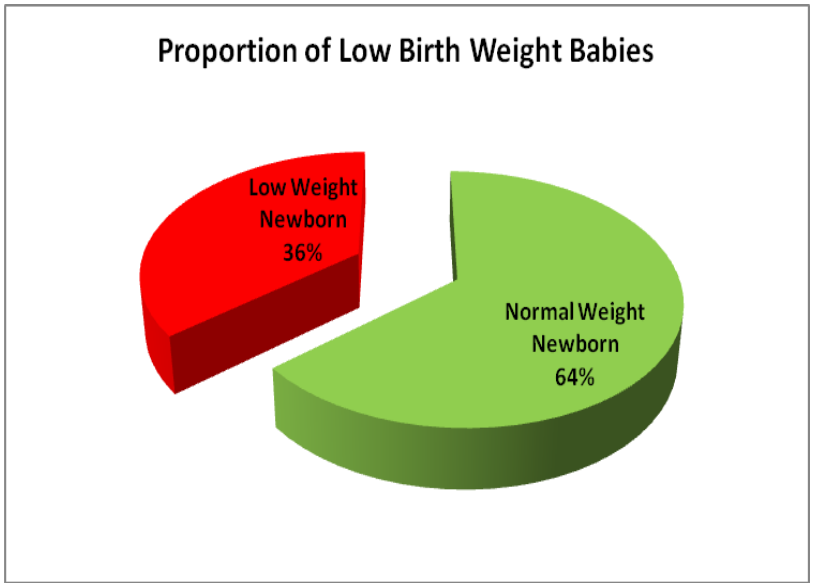
III. RESULTS

Out of total 100 newborn born by 100 identified mothers, 36% were with low weight (<2500 grams). Ratio between Normal Birth Weight babies (NBW) and Low Birth Weight babies (LBW) was found 1.8:1. (Figure 1)

Figure 1



When association of maternal serum Zinc level and birth weight was revealed it was observed that mean Serum Zinc was 81.33 ± 17.16 and 45.96 ± 15.14 in NBW and LBW infant's mothers respectively revealing significant difference(**P<0.001)**. So lower level of Serum zinc is more prone to have more LBWs. (Table 1).

Likewise, when association of maternal serum Zinc Copper and birth weight was revealed it was observed that mean Serum Copper was 96.23 ± 11.44 and 109.55 ± 14 in NBW and LBW infant's mothers respectively revealing significant difference (**P<0.001)**. So in contrast to serum Zinc, higher level of Serum Copper is more prone to have more LBWs. (Table 1).

But when association of maternal serum Zinc Iron and birth weight was revealed it was observed that mean Serum Iron was 90 ± 31.99 and 87.66 ± 28.40 in NBW and LBW infant's mothers respectively. Although LBWs mothers had lower level of serum Iron level but it was not found significant **(P>0.05).** (Table 1).

Table 1

Association of Maternal Zinc, Copper and Iron with Birth Weight of Newborn

S. No.	**Maternal Trace Elements**	**Normal Birth Weight N=64 (Mean ± SD)**	**Low Birth Weight N=36 (Mean ± SD)**	**Unpaired Student 't' test P Value**	**LS**
1	**Serum Zinc ug/dl**	81.33 ± 17.16	45.96 ± 15.14	**P<0.001**	**S**
2	**Serum Copper ug/dl**	96.23 ± 11.44	109.55 ± 14	**P<0.001**	**S**
3	**Serum Iron ug/dl**	90 ± 31.99	87.66 ± 28.40	**P=0.716**	**S**

When association of newborn cord's serum Zinc level and birth weight was revealed it was observed that mean Serum Zinc was 114.22±18.54 and 86.75±16.75 in NBW and LBW infants respectively revealing significant difference(**P<0.001)**. So lower level of newborn cord's Serum zinc is more prone to have more LBWs. (Table 2).

Likewise, when association of newborn cord's serum Zinc Copper and birth weight was revealed it was observed that mean Serum Copper was 100.54±_14.23 and 112.85±12.36 in NBW and LBW infants

respectively revealing significant difference (**P<0.001)**. So in contrast to serum Zinc, higher level of newborn cord's Serum Copper is more prone to have more LBWs. (Table 2).

And when association of newborn cord's serum Zinc Iron and birth weight was revealed it was observed that mean Serum Iron was 127.30±26.27 and 142.14±28.40 in NBW and LBW infants respectively revealing significant difference (**P<0.001).** So in contrast to serum Zinc and similar to serum Copper, higher level of newborn cord's Serum Iron is more prone to have more LBWs. (Table 2).

Table 2

Association of Newborn Zinc, Copper and Iron with Birth Weight of Newborn

S. No.	**Newborn Trace Elements**	**Normal Birth Weight N=64 (Mean ± SD)**	**Low Birth Weight N=36 (Mean ± SD)**	**Unpaired Student 't' test P Value**	**LS**
1	**Serum Zinc ug/dl**	114.22±18.54	86.75±16.75	**P<0.001**	**S**
2	**Serum Copper ug/dl**	100.54±_14.23	112.85±12.36	**P<0.001**	**S**
3	**Serum Iron ug/dl**	127.30±26.27	142.14±28.40	**P<0.001**	**S**

IV. DISCUSSION

This present study is to explores the impact of maternal trace element status on birth weight. But the trace element which measured were only zinc, Copper and Iron.

It was observed in this study that mean maternal Serum Zinc was significantly lower in LBW than NBW infant's mothers (**P<0.001)**. And similar result is obtained as per cord's blood of infant. So lower level of Serum zinc is more prone to have more LBWs. However, few authors found no significant association between serum zinc and birth weight like Ugwuja et al [14] and Tamura et al[15]. But studies reported that in developing countries, mild to moderate zinc deficiency associated with low birth weight babies (LBWs) [16, 17,18.]

It was observed in this study that mean maternal Serum Copper was significantly higher in LBW than NBW infant's mothers (**P<0.001)**. And similar result is obtained as per cord's blood of infant. So higher level of Serum Copper is more prone to have more LBWs. The observed higher levels of copper in cord blood than that in mother blood may be caused by increased mobilization of stored copper in tissues, especially the liver, for its use by the developing fetus[19].

In this study mean maternal Serum Iron lower in LBW and NBW infant's mothers respectively. But observations of cord's blood were contrast to it i.e. higher serum Iron in LBWS. So Association of Serum iron with weight was not depicted. Findings of this study were in close agreement with previous reports [20,21,22]; the levels were not altered significantly during pregnancy and no correlation with birth weight was observed.

V. CONCLUSION

It was found in this study that maternal and newborn serum Zinc and Copper level were significantly lower and higher respectively in LBWs whereas maternal and newborn serum Iron were lower LBWs.

So it can be concluded that the trace element is Zinc and Copper that effect the growth of infant and lower mother serum zinc level and higher serum Copper level is responsible is more prone to low birth weight infants.

CONFLICT OF INTEREST

None declared till now.

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